

**SOF NATIONAL SCIENCE
OLYMPIAD 2023-24**

CLASS
9

QUESTION
PAPER SET

A

DO NOT OPEN THIS BOOKLET UNTIL ASKED TO DO SO

Total Questions: 50 | Time: 1 hr.

Guidelines for the Candidate

1. You will get additional ten minutes to fill up information about yourself on the OMR Sheet, before the start of the exam.
2. Write your **Name, School Code, Class, Section, Roll No.** and **Mobile Number** clearly on the **OMR Sheet** and do not forget to sign it. We will share your marks / result and other information related to SOF exams on your mobile number.
3. The Question Paper comprises three sections:
Logical Reasoning (10 Questions), **Science** (35 Questions) and **Achievers Section** (5 Questions)
Each question in Achievers Section carries 3 marks, whereas all other questions carry one mark each.
4. All questions are compulsory. There is no negative marking. Use of calculator is not permitted.
5. There is only ONE correct answer. Choose only ONE option for an answer.
6. To mark your choice of answers by darkening the circles on the OMR Sheet, use **HB Pencil** or **Blue / Black ball point pen** only. E.g.
Q.16: In the water cycle, condensation is the process of
A. Water vapour cooling down and turning into a liquid B. Ice warming up and turning into a liquid
C. Liquid cooling down and turning into ice D. Liquid warming up and turning into water vapour
As the correct answer is option A, you must darken the circle corresponding to option A on the OMR Sheet.
7. Rough work should be done in the blank space provided in the booklet.
8. Return the OMR Sheet to the invigilator at the end of the exam.
9. Please fill in your personal details in the space provided before attempting the paper.
10. **For classes 8, 9 & 10, "Innovation Challenge" is being conducted by Techfest IIT Bombay in association with SOF. For details and to participate, please turn to last page.**

16. ● (B) (C) (D)

Name:.....

SOF Olympiad Roll No.:..... Contact No.:.....

1. Study the given information carefully and answer the following question.

'P + Q' means 'P is the mother of Q'.

'P × Q' means 'P is the father of Q'.

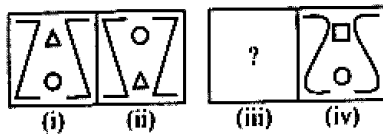
'P - Q' means 'P is the son of Q'.

'P ÷ Q' means 'P is the daughter of Q'.

How is N related to J in $L \times N + M - K \div J$?

- A. Daughter B. Sister
C. Daughter-in-law D. Mother-in-law

2. There is a definite relationship between figures (i) and (ii). Establish a similar relationship between figures (iii) and (iv) by selecting a suitable figure from the options that would replace the (?) in Fig. (iii).



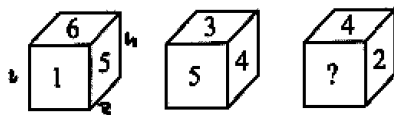
- A. B. C. D.

3. Arrange the given words in the order in which they occur in the dictionary and select the correct option.

1. Prevent 2. Prepare 3. Protection
4. Previous 5. Prefer

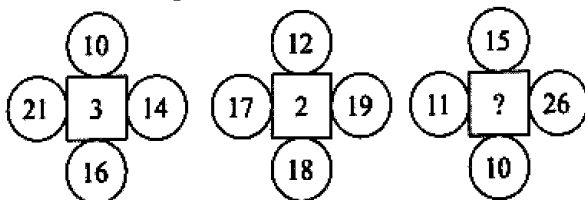
- A. 2, 1, 5, 4, 3 B. 5, 2, 1, 4, 3
C. 5, 1, 2, 3, 4 D. 5, 1, 2, 4, 3

4. Three different positions of a dice are shown here. Select the number from the given options that will replace the question mark(?) in the given dice.



- A. 5 B. 3 C. 6 D. 1

5. Find the missing number, if same rule is followed in all the three figures.

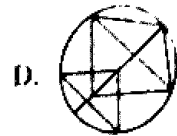
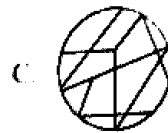


- A. 7 B. 4 C. 8 D. 6

6. Select a figure from the options in which the given figure is exactly embedded as one of its parts.



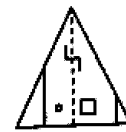
- A. B.



7. Prerna using her bicycle travels 40 m towards South. She then turns left and travels 40 m and then turns right and travels 50 m. She then turns left again and travels 50 m. Finally, she turns left and travels 60 m. How far is she now from the starting point?

- A. $30\sqrt{10}$ m B. $10\sqrt{35}$ m
C. $10\sqrt{30}$ m D. $9\sqrt{30}$ m

8. A transparent sheet with a pattern and a dotted line on it is given. Select a figure from the options as to how the pattern would appear when the transparent sheet is folded along the dotted line.

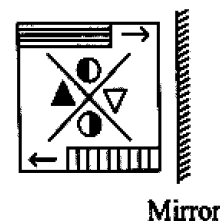


- A. B.
C. D.

9. Seven friends P, Q, R, S, T, U and V are sitting around a circular table facing the centre. T sits third to the left of Q. P is immediate neighbour of both U and R. U sits third to the left of T. S is not sitting beside Q. Which of the following are immediate neighbours of V?

- A. Q and P B. R and S
C. Q and S D. T and P

10. Select the correct mirror image of the given figure.

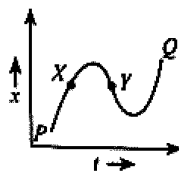


- A. B.
C. D.

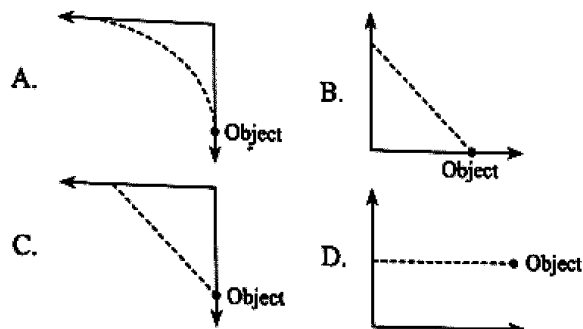
11. The position (x) - time (t) graph in the given figure describes the motion of a particle along x -axis between two positions P and Q . Also, the particle passes through two intermediate points X and Y .

Which one of the following options is correct for instantaneous velocity at X and Y ?

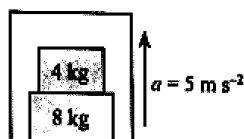
- | | | |
|----|----------|----------|
| | X | Y |
| A. | Positive | Positive |
| B. | Negative | Positive |
| C. | Positive | Negative |
| D. | Negative | Negative |



12. Which one of the following figures best represents the path (through dotted points) of a bullet fired horizontally, aiming at an object which starts falling at the instant the bullet is fired?

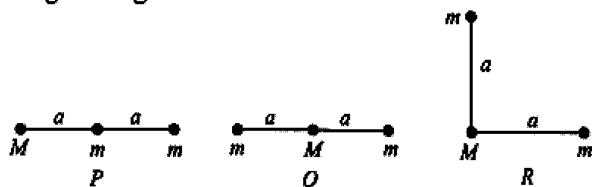


13. Two blocks of mass 4 kg and 8 kg are kept in a lift accelerating upward with an acceleration of 5 m s^{-2} as shown in the given figure. Select the incorrect statement(s). (Take $g = 10 \text{ m/s}^2$)



- The normal force between block of mass 8 kg and floor of the lift is 180 N.
 - The normal force between blocks of mass 8 kg and 4 kg is 80 N.
 - Normal force is always perpendicular to the plane surface at the point of contact.
- A. (i) and (ii) only B. (ii) only
C. (i) and (iii) only D. (ii) and (iii) only

14. Three particles, one with mass ' M ' and two with masses ' m ' are arranged in three configurations as shown in the given figures.



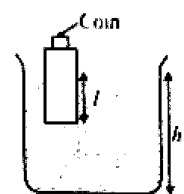
Arrange the given configurations from greatest to least according to the magnitude of the gravitational force on M .

- A. R, P, Q B. P, Q, R C. R, Q, P D. P, R, Q

15. A wooden block, with a coin placed on its top, floats in water as shown in the given figure. Respectively the length and height, l and h are also indicated here.

After some time, the coin falls into the water, then

- l decreases and h increases
- l increases and h decreases
- Both l and h increase
- Both l and h decrease.



16. A block of mass, $m = 0.2 \text{ kg}$ is hanging over a frictionless light fixed pulley by an inextensible string of negligible mass. The other end of the string is pulled by a constant force F in the vertically downward direction as shown in the given figure. The linear momentum of the block increases by 2 kg m/s in 1 s after the block starts from rest. (Take $g = 10 \text{ m/s}^2$) Match column I with column II and select the correct option from the given codes.

Column I		Column II
P. Tension in the string	(i)	10 J
Q. Work done by the tension on the block	(ii)	4 N
R. Work done against the force of gravity	(iii)	3 N
	(iv)	20 J
A. P-(ii), Q-(iv), R-(i)		
B. P-(iii), Q-(i), R-(iv)		
C. P-(ii), Q-(i), R-(iv)		
D. P-(iv), Q-(ii), R-(iii)		

17. A body of mass 2 kg is thrown up vertically with a kinetic energy of 490 J. If the acceleration due to gravity is 9.8 m s^{-2} , the height at which the kinetic energy of the body becomes half of the original value is
- A. 50 m B. 25 m C. 12.5 m D. 10 m

18. Earthquake generates sound waves inside the Earth which consists of both transverse (S) and longitudinal (P) sound waves. The speed of S wave is about 5.0 km/s and that of P wave is 10.0 km/s. A seismograph records the P and S waves. The first P wave arrives 4 minutes before the first S wave. Assuming the waves travel in straight line, at what distance did the Earthquake occur?

- A. 1750 km B. 2250 km C. 2400 km D. 1920 km

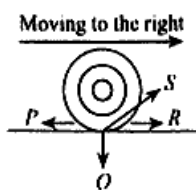
19. An aeroplane is going towards East at a speed of 450 km h^{-1} at a height of 1,000 m. At a certain instant, the sound of the plane heard by a ground observer appears to come from a point vertically above him. Where will be the plane at this instant? [Speed of sound in air is 340 m s^{-1} .]

- 833 m ahead of the observer.
- 833 m behind the observer.
- 368 m ahead of observer.
- 368 m vertically above the observer.

20. Two plane mirrors are inclined to each other such that a ray of light incident on the first mirror M_1 and parallel to the second mirror M_2 is finally reflected from the second mirror M_2 and parallel to the first mirror M_1 . The angle between the two mirrors will be
A. 60° B. 45° C. 75° D. 90°

21. Which of the following statement(s) is/are correct?
(i) A body is said to be neutral if the number of protons exceeds the number of electrons.
(ii) Electric charges can occur between two clouds with like charges when they come near each other causing lightning and thunder.
(iii) An electroscope is used to detect the presence of electric charge.
A. (ii) only B. (i) and (iii) only
C. (iii) only D. (i), (ii) and (iii)

22. The given figure shows the rear wheel of a car that is moving to the right. The force which represents the frictional force acting on the rear wheel, as it moves to the right, is



- A. Q B. R
C. P D. S

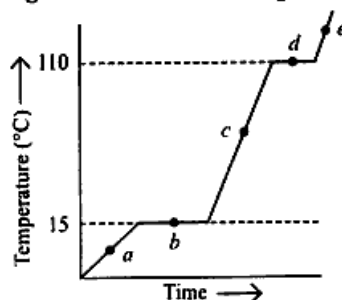
23. The schematic atomic structures of three elements P , Q and R are given as :



The element P combines with elements Q and R respectively to form (i) and (ii) types of compounds.

- (i) (ii)
A. PQ_3 PR
B. PQ PR_2
C. PQ PR_3
D. P_2Q P_3R
24. Sneha and Dinesh were doing an experiment in which water was to be heated in a beaker. Sneha kept the beaker near the wick in the yellow part of the candle flame. Dinesh kept the beaker in the outermost part of the flame. Select the correct observation regarding this experiment.
A. Water boiled faster in case of Sneha.
B. Same time was taken to get the water boiled in both the cases.
C. Water boiled in a shorter time in case of Dinesh.
D. None of the given observations is correct.

25. The given figure shows the heating curve of wax.



Read the given passage carefully and fill in the blanks by selecting the correct option.

The melting point of wax is (i) and its boiling point is (ii). At points c and d , the states of wax are (iii) and (iv) respectively.

(i)	(ii)	(iii)	(iv)
A. 15°C	110°C	Solid	Liquid
B. 110°C	15°C	Liquid	Gas
C. 95°C	130°C	Solid	Vapours
D. 15°C	110°C	Liquid	Gas

26. Fill in the blanks by selecting the correct option.
(i) is less polluting fuel than petrol, (ii) is an almost pure form of carbon and (iii) is a mixture of about 200 substances.

(i)	(ii)	(iii)
A. Diesel	Coal	Coke
B. CNG	Coke	Coal tar
C. Kerosene	Coke	Coal gas
D. CNG	Coal tar	Coke

27. Few substances are listed in the given box :

Camphor (i)	Dry ice (ii)	Soil (iii)	Aerated drink (iv)
Brass (v)	Ammonium chloride (vi)	Tincture of iodine (vii)	

Classify the given substances into compounds and mixtures.

Compounds	Mixtures
A. (ii), (v), (vi)	(i), (iii), (iv), (vii)
B. (iii), (iv), (v), (vii)	(i), (ii), (vi)
C. (i), (ii), (vi)	(iii), (iv), (v), (vii)
D. (i), (ii), (vi), (vii)	(iii), (iv), (v)

28. Read the given statements carefully.

- I. Biogas is a better fuel than petrol.
II. Kerosene oil does not vapourise while burning and hence produces flame.
III. Oxides of sulphur and nitrogen cause acid rain.
IV. Burning of phosphorus in air at room temperature is an example of spontaneous combustion.

Select the correct statement(s).

- A. II only B. I, III and IV only
C. III and IV only D. I, II, III and IV

29. Read the following statements carefully and select the option that correctly identifies them as true (T) and false (F) ones.

- I. The formula unit mass of calcium sulphite is 100 u.
II. Carbon dioxide obtained by heating sodium hydrogen carbonate and by the reaction of dilute hydrochloric acid with sodium hydrogen carbonate consists of carbon and oxygen in the ratio 3 : 8 by mass.
III. Ozone is triatomic while sulphur is poly-atomic.
IV. Nitride is an anion while phosphate is a cation.

I	II	III	IV
A. T	T	F	F
B. F	T	T	F
C. F	F	T	T
D. T	F	T	F

30. Read the following statements carefully and identify W, X, Y and Z.

- I. W is used in jet aircrafts.
- II. X is used in paints.
- III. Y is used as an aviation fuel.
- IV. Z is used as fuel for home.

W	X	Y	Z
A. Kerosene	Paraffin wax	Diesel	LPG
B. CNG	Diesel	Hydrogen gas	Petrol
C. Kerosene	Bitumen	Petrol	LPG
D. Bitumen	Coal tar	Petroleum gas	Kerosene

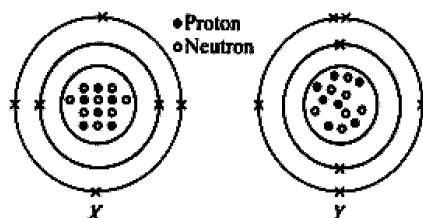
31. Four different experiments were conducted in the following ways :

- I. 3 g of carbon was burnt in 8 g of oxygen to give 11 g of CO_2 .
- II. 1.2 g of carbon was burnt in air to give 4.2 g of CO_2 .
- III. 4.5 g of carbon was burnt in enough air to give 11 g of CO_2 .
- IV. 4 g of carbon was burnt in oxygen to form 30.3 g of CO_2 .

Law of constant proportions is not illustrated in experiment(s)

- A. I and III only
- B. II, III and IV only
- C. IV only
- D. I only.

32. The given diagrams show the atomic structures of elements X and Y.



Select the correct statement(s).

- I. Nucleon numbers of elements X and Y are 16 and 14 respectively.
 - II. Proton numbers of elements X and Y are 6 and 7 respectively.
 - III. Elements X and Y are represented by $^{14}_6\text{X}$ and $^{16}_7\text{Y}$ respectively.
 - IV. Elements X and Y are isobars.
- A. I only
 - B. III and IV only
 - C. II, III and IV only
 - D. I and III only

33. Read the given passage and select the option that correctly identifies X and Y.

X are the most abundant blood cells in humans. The formation of X is known as Y.

X	Y
A. WBCs	Leucocytosis
B. RBCs	Erythropoiesis
C. Lymphocytes	Haemopoiesis
D. RBCs	Thrombopoiesis

34. Which of the following statements is incorrect regarding peroxisomes?

- A. They are present in both plant and animal cells.
- B. They are responsible for removing toxic substances from the cell.
- C. They are involved in photorespiration in plants.
- D. They are bounded by double membrane and contain oxidative enzymes.

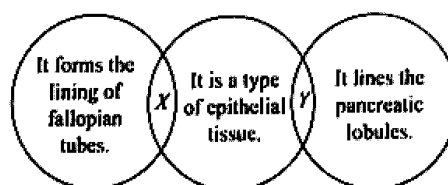
35. Refer to the given table of differences between cell wall and plasma membrane.

	Cell wall	Plasma membrane
(i)	It is present in plant cells and most prokaryotic cells.	It is present in all types of cells.
(ii)	It is thin and living.	It is thick and non-living.
(iii)	It is flexible.	It is rigid.
(iv)	It is made up of pectin, cellulose and hemicellulose.	It is made up of lipids, proteins and carbohydrates.

Identify the incorrect set of difference(s) and select the correct option.

- A. (i) only
- B. (ii) and (iii) only
- C. (ii) only
- D. (iii) and (iv) only

36. Refer to the given Venn diagram and select the option that correctly identifies X and Y.



- | X | Y |
|------------------------|----------------------|
| A. Squamous epithelium | Cuboidal epithelium |
| B. Ciliated epithelium | Glandular epithelium |
| C. Cuboidal epithelium | Columnar epithelium |
| D. Squamous epithelium | Ciliated epithelium |

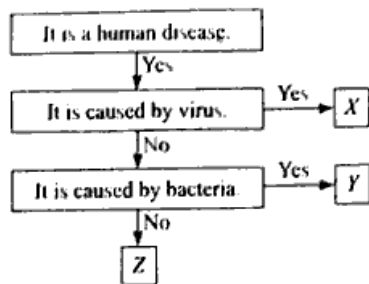
37. Which among the following are the advantages of manure?

- I. It enriches the soil with nutrients.
 - II. It is quickly absorbed by the plant roots.
 - III. It improves the water retention capacity of the soil.
 - IV. It improves the texture of soil.
 - V. It is environment friendly.
- A. I, II and III only
 - B. II, IV and V only
 - C. I, III, IV and V only
 - D. I, II, III, IV and V

38. Select the correct match.

- | | | |
|--------------------------|---|-------------|
| A. <i>Apis indica</i> | – | Dwarf bee |
| B. <i>Apis dorsata</i> | – | Rock bee |
| C. <i>Apis florea</i> | – | Italian bee |
| D. <i>Apis mellifera</i> | – | Indian bee |

39. Refer to the given flow chart and select the option that correctly identifies X, Y and Z.



X	Y	Z
A. Tetanus	Ringworm	Pneumonia
B. Chickenpox	Athlete's foot	Mumps
C. Typhoid	Measles	Flu
D. Polio	Cholera	Malaria

40. The tissue shown in the given figure is



- A. Angular collenchyma, in which wall thickenings are present at the angles
 B. Sclerenchyma, in which uniform wall thickenings are present
 C. Xylem vessel that forms long channels for conduction of water and minerals
 D. Phloem parenchyma with abundant food reserve.

41. Refer to the given analogy and select the option that correctly identifies X.

Mustard : Rabi crop :: X : Kharif crop

- A. Bajra B. Wheat C. Pea D. Gram

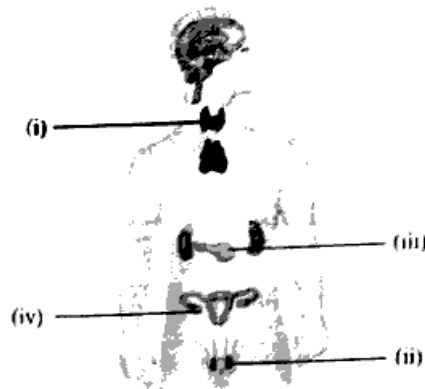
42. Refer to the given characteristics of an organism and select the option that correctly identifies it.

A. <i>Chlamydomonas</i>	• Unicellular
B. <i>Rhizopus</i>	• Devoid of chlorophyll
C. Yeast	• Saprophytic
D. <i>Trypanosoma</i>	• Reproduces by budding

43. Select the incorrect match of National Park and its famous fauna.

National Park	Famous for
A. Desert National Park	Chinkara
B. Sundarbans National Park	Royal Bengal tiger
C. Gir National Park	One-horned rhinoceros
D. Jim Corbett National Park	Elephant

44. Identify the glands (i)-(iv) in the given figure and select the incorrect match of gland with its secretion.



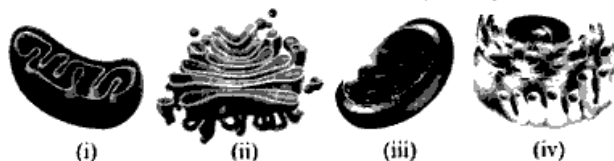
Gland	Hormone secreted
A. (i)	Thyroxine
B. (ii)	Relaxin
C. (iii)	Insulin
D. (iv)	Inhibin

45. Read the following statements (a-c) and select the option which correctly fills up the blanks in any two statements.

- (a) (i) is an indigenous breed of cattle and (ii) is an indigenous breed of poultry.
 (b) Kharif crops are cultivated from (iii) to (iv).
 (c) Berseem is an important (v) crop.
 A. (i)-Red Sindhi, (ii)-Australorp, (iii)-June, (iv)-October
 B. (iii)-June, (iv)-October, (v)-Fodder
 C. (i)-Jersey, (ii)-Busra, (v)-Field
 D. (iii)-November, (iv)-April, (v)-Rabi

ACHIEVERS SECTION

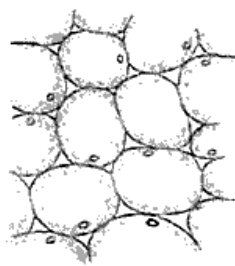
46. Identify the organelles (i)-(iv) from the given figures and select the correct statement regarding them.



- A. (i), (ii) and (iv) are single membrane bound organelles whereas, (iii) is a double membrane bound cell organelle.

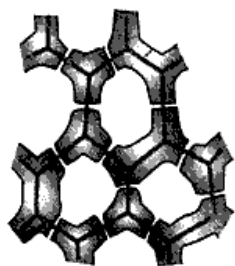
- B. (i) and (iii) contain DNA in their cytoplasm whereas, the cytoplasm of (ii) and (iv) is devoid of DNA.
 C. (i) and (ii) are involved in membrane biogenesis whereas, (iii) and (iv) are the sites of photosynthesis.
 D. (ii), (iii) and (iv) are present in both plant and animal cells whereas, (i) is present only in animal cells.

47. Identify the plant tissues (i) and (ii) in the given figures and select the option that correctly identifies their location.



(i)

(i)

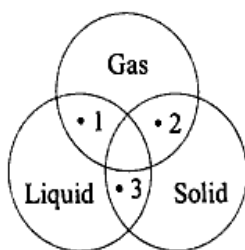


(ii)

(ii)

- | | |
|--------------------------------|------------------------------------------------------|
| A. Mesophyll of leaves | Husk of coconut |
| B. Stem of flax plant | Beneath the epidermis in young leaves of dicot plant |
| C. Hard covering of seeds | Leaves of aquatic plants |
| D. Leaves of herbaceous dicots | Epidermis of monocot roots |

48. Study the given Venn diagram carefully.

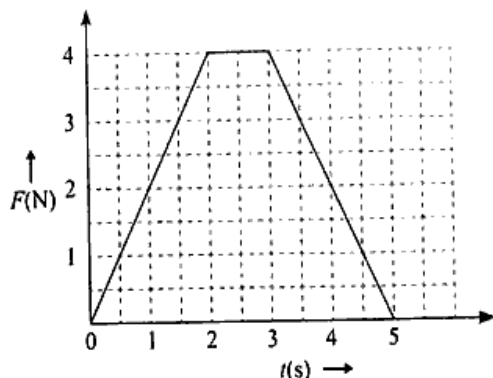


Which of the following statements is/are correct regarding 1, 2 and 3?

- I. Point 1 represents gel like milk.
- II. Point 2 represents solid foam like sponge.
- III. Point 3 represents a sol type colloidal solution and it can be milk of magnesia.
- IV. Point 1 can represent fog as well as milky glass.

- | | |
|------------------------|----------------------|
| A. II and III only | B. I only |
| C. II, III and IV only | D. I, II, III and IV |

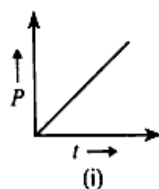
49. The given graph represents the variation of magnitude of net force (F) exerted in x direction on a 2.50 kg particle with time. On the basis of given graph, fill in the blanks by selecting the correct option.



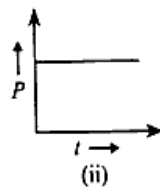
The impulse of the force is (i) kg m s^{-1} . Final velocity of the particle, if it is originally at rest is (ii) m s^{-1} . Its final velocity if its original velocity is -2.0 m s^{-1} , is (iii) m s^{-1} . The average force exerted on the particle for the time interval 0 to 5 s is (iv) N.

- | | (i) | (ii) | (iii) | (iv) |
|----|-----|------|-------|------|
| A. | 12 | 2.8 | 2.4 | 4.8 |
| B. | 6 | 2.4 | 2.8 | 4.8 |
| C. | 12 | 4.8 | 2.8 | 2.4 |
| D. | 24 | 4.8 | 2.4 | 2.8 |

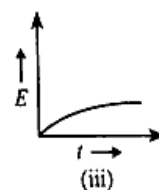
50. A vehicle is driven along a straight horizontal track by a motor which exerts a constant driving force. The vehicle starts from rest at $t = 0$ and the effects of the friction and air resistance are negligible. If the kinetic energy of the vehicle at time t is E and power developed by the motor is P , which of the following graphs is/are incorrect?



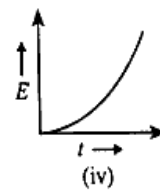
(i)



(ii)



(iii)



(iv)

- | | |
|----------------------|------------------------|
| A. (i) and (iv) only | B. (ii) only |
| C. (i) only | D. (ii) and (iii) only |

SPACE FOR ROUGH WORK